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(54) SURFACE TREATMENT APPARATUS

(71) We, WAGGONFABRIK UERDINGEN A.G., a German Company, of Werk Düsseldorf, D-4000 Düsseldorf, Konigsberger Strasse 100, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for grinding or other surface treatment of a plane or slightly curved surface particularly, but not exclusively surface grinding, to prepare a surface for painting or lacquering.

A known surface grinding machine has abrasive carriers which are connected rigidly with a rotary drive spindle. Although the abrasive carrier may be made flexible to allow it to distort so as to avoid grinding marks caused by the abrasive at the peripheral edges of the carrier, a slight true-running inaccuracy, concentricity error or guiding defect in the machine may cause crescent-shaped grinding marks which are often not detected until the paint has been applied, and which can be eliminated only with difficulty. Providing thicker and more flexible abrasive carrier plates to counteract this has the further disadvantage that such abrasive carriers adapt themselves to an uneven working surface, and do not level it satisfactorily.

The present invention has as one object to provide simple and inexpensive apparatus which does not cause edge grinding marks and furthermore permits the use of relatively rigid abrasive carriers in order to achieve satisfactory grinding of the surface. However the invention is also applicable to apparatus for surface treatment other than grinding, e.g. polishing.

According to the present invention there is provided apparatus for grinding or other surface treatment of a plane or slightly curved surface, comprising a rotatably drivable member which carries for bodily rotation therewith at least two disc-shaped carriers, adapted to carry abrasive or other surface treating substance, the axes of the disc-shaped carriers, being offset from the rotary axis of the drivable member and each disc-shaped carrier being connected to the drivable member so that it is freely rotatable about its own axis and so that it is pivotable in all directions about a point lying on its own axis whereby, in use, the carriers are capable of aligning against both planar and slightly curved surfaces.

In order to make it possible to connect the drivable member to drive means, for example by way of flat or V-belts, and at the same time to arrange a relatively large number of carriers to achieve steady running of the apparatus in the working position, according to one feature of the invention it is proposed that the pivot points of the carriers are equidistant from the axis of the driable member, and may be arranged in diametrally opposite pairs. Preferably the axis of rotation of the carriers are angularly equispaced about the axis of the drivable member.

In order that all the carriers may align against the surface to be treated, regardless of constructional deviations in the apparatus, and in order to obtain steady running of the apparatus in the working position, according to a further feature of the invention it is proposed that the drivable member comprises at least two arms extending radially of its axis and being resilient in the direction parallel to the axis of the drivable member, the carriers being mounted on the arms at equal distances from the axis of the drivable member.

In a specific construction as applied to surface grinding apparatus, in order that the pivoting point of each abrasive carrier may coincide as far as possible with its centre of gravity and to make each abrasive carrier, whilst having a certain flexibility, more rigid in general and therefore more advantageous for obtaining better levelling of the surface being ground, according to another feature of the invention it is proposed that the carrier consists of an abrasive carrying plate and a pivot bearing plate between which is retained a flexible annular intermediate ring, and there is secured on the retaining plate a member, having a socket of a ball-and-socket pivot, which projects into the

[*Price 33p*]

free space of the annular ring; preferably the bearing member is axially thinner that the flexible annulus so that it does not come into contact with the abrasive carrying plate.

A simple, inexpensive, space-saving construction of the rotary and pivot bearing which is not exposed to soiling, and which permits easy interchanging of the abrasive carriers which may be necessary in operation, is made possible according to another feature of the invention in that the bearing member is provided with a conically-ended socket for receiving a swivel head of a pin extending through a hole in the retaining plate; the pin is connected releasably and axially adjustably at its other end to the drivable member.

Specific advantages which can be obtained with the apparatus of the invention comprise more particularly the following:

In operation, a grinding effect is obtained only when the abrasive carrier lies against the surface to be ground over a large surface area; a uniform action of the abrasive is obtained, with an even grinding pattern. Since, within the annular surface swept by the abrasive carriers, the distribution of abrasive decreases from the central region of the said surface towards the inside and outside edges in a continuous manner, the transition region between the annular surface edges and the unswept surface is free of marks. The apparatus is also not sensitive to concentricity errors, application and guiding errors, and more particularly when the apparatus is guided by hand it is not dependent on the "feel" of the operator. Because it is unaffected in this way, furthermore, on the one hand it is possible to use abrasive carriers providing rigid supports for the grinding paper, thus achieving a substantially better levelling effect on the surface being ground, and also it is possible to use harder grinding materials with a longer working life, making it possible to work without so many interruptions.

The use of the harder grinding materials is particularly advantageous if the apparatus is mechanically guided. With this kind of guiding and with such grinding materials, the apparatus according to the invention can be used in a particularly economical manner with the use of automatic control of the guiding system.

The invention may be carried into practice in a number of ways, but several specific embodiments will now be described, by way of example only, with reference to the accompanying drawings, in which:—

Figure 1 shows a basic view of one embodiment of apparatus according to the invention,

Figure 2 shows a section taken on the A-A in Figure 1 on a larger scale,

Figure 3 shows a view in elevation of an embodiment according to the invention arranged for hand guiding,

Figure 4 shows a section taken on the line B-B of Figure 3,

Figure 5 shows a further embodiment of the drivable member used in the appratus according to the invention,

Figure 6 shows a side view of Figure 5,

Figure 7 shows a mechanically guided apparatus in elevation, and

Figure 8 shows a side view of Figure 7.

Referring to Figure 1 and Figure 2 an abrasive carrier 3 is mounted for free rotation on a drivable member 2 by a pin 12, one end of which comprises a screw thread and which is provided with a lock nut 13, the end face of the pin being provided with a slot 14 for adjusting the carrier 3 in the longitudinal direction. The carrier 3 comprises an abrasive carrying plate 6 and a pivot bearing retaining plate 5 with a flexible annular ring 7 arranged between the plates and adhesively secured thereto. In the free space within the annular ring 7 there is arranged a bearing member 8 which is connected with the retaining plate 5 and which, in a conically-ended socket 10, receives a swivel head ball 11 of the pin 12. The rotary and the pivot bearing 8 is thinner than the annular ring 7, and so does not extend as far as the abrasive carrying plate 6, provided with an abrasive 9, so that no contact can take place during operation between the surface to be ground and the surface of the bearing member 8. The carriers 3 are also designed to achieve a stable position of equilibrium.

During a grinding operation, varying rotational movements of each carrier 3 on its own axis (indicated by double arrows in Figure 1) takes place in accordance with the friction which occurs between the abrasive 9 and the surface being ground. As a result the individual abrasive particles of the abrasive material 9 move on paths of revolution which vary continuously relatively to the axis of the drivable member 2, so that a balanced grinding pattern is produced which is free of annular zones.

In the case of hand guiding as shown in Figure 3 and Figure 4 the apparatus comprises a drive 1, in this case an angle drive of the electric motor type which is operatively connected to a housing 15; this housing contains a drivable member 2 constructed as a V-belt pulley on which four carriers 3 are arranged in diametrically opposite pairs substantially equidistant from the axis of the drivable member 2. This asix is provided with a through bore and a connecting conduit 16 for water supply to the article being ground. A V-belt 18 subjected to the action of a tensioning pulley 17 operatively connects the drivable member 2 with a driving pulley 19 of the angle drive.

In Figure 5 and Figure 6 there is shown a drivable member 2 which is adapted to be connected to a drive for example the angle drive shown in Figure 4, and which comprises four arms 4 arranged in the form of a cross. These arms have mounted on their respective free ends carriers 3 which are arranged

equidistant from the axis of the drivable member and are constructed to be flexible in the direction parallel to that axis.

In the case of mechanical guiding of the apparatus, as shown in Figure 7 and Figure 8, a drivable member 2 provided with four carriers 3 is pivotably suspended together with its drive 1 by means of a rod 20 on a carriage 21. The carriage 21 is adapted to move in a vertical direction by means of a lifting device 24 within a guide frame 23 arranged on a trolley 22. As Figure 8 shows, the drivable member 2 and drive 1 are pivotably attached in such a manner as to urge the apparatus towards the article being ground, in this case a side wall 25 of a railway vehicle.

WHAT WE CLAIM IS:—

1. Apparatus for grinding or other surface treatment of a plane or slightly curved surface, comprising a rotatably drivable member which carries for bodily rotation therewith at least two disc-shaped carriers adapted to carry abrasive or other surface treating substance, the axes of the disc-shaped carriers being offset from the rotary axis of the drivable member and each disc-shaped carrier being connected to the drivable member so that it is pivotable in all directions about a point lying on its own axis whereby in use, the carriers are capable of aligning against both planar and slightly curved surfaces.

2. Apparatus as claimed in claim 1, in which the pivot points of the carriers are equidistant from the axis of rotation of the drivable member.

3. Apparatus as claimed in claim 1 or claim 2, in which an even number of carriers are provided, each being arranged diametrally opposite another carrier.

4. Apparatus as claimed in any one of the preceding claims, in which the axes of the carriers are angularly equispaced about the axis of the drivable member.

5. Appratus as claimed in any one of the preceding claims, in which the drivable member is provided with at least two arms extending radially of the axis of the drivable member, the arms being resilient in the direction parallel to the axis of the drivable member, the abrasive carriers being mounted on the arms.

6. Apparatus as claimed in any one of claims 1 to 4, in which the drivable member is provided with a disc-shaped support to which the disc-shaped carriers are connected.

7. Apparatus as claimed in any one of the preceding claims in which each carrier consists of a flexible annulus retained between an abrasive carrying plate and a pivot bearing retaining plate, there being rigidly fixed to the retaining plate a bearing member having a socket of a ball-and-socket pivot, the bearing member being located in the space within the annular ring.

8. Apparatus as claimed in claim 7, in which the bearing member is axially thinner than the flexible annulus whereby a space is afforded between the bearing member and the abrasive carrying plate.

9. Apparatus as claimed in claim 7 or claim 8, in which the bearing member has a conically-ended socket which receives a swivel head ball of a pin the other end of which pin extends through a hole in the retaining plate and is connected to the drivable member.

10. Apparatus as claimed in claim 9, in which the pin is releasably and axially adjustably connected to the drivable member.

11. Apparatus as claimed in any one of the preceding claims, in which the drivable member is connected with a rotary drive and in which means are provided for automatically guiding the drivable member for bodily movement over a predetermined path.

12. Apparatus substantially as specifically described herein with reference to Figures 1 and 2, or to Figures 3 and 4, or to Figures 5 and 6, or to Figures 7 and 8 of the accompanying drawings.

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Sheet 1

Fig. 1

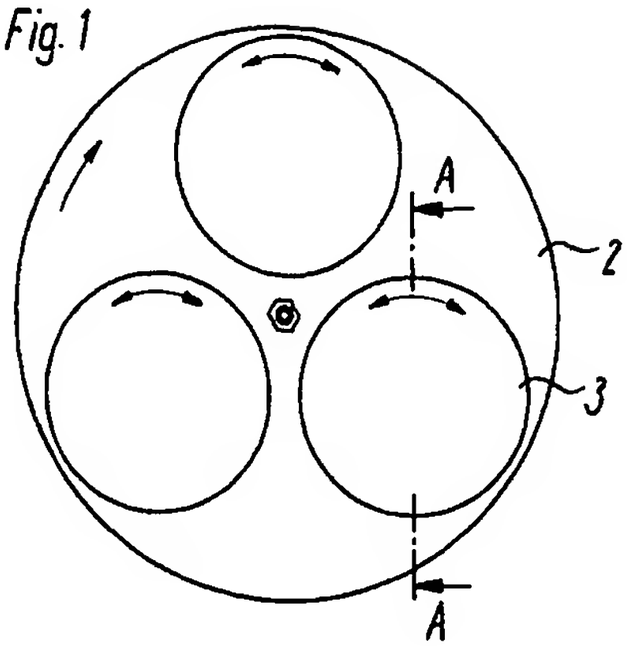

Fig. 2

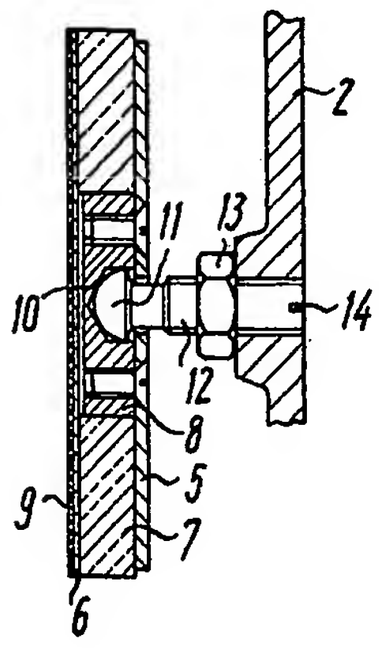

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Fig.3

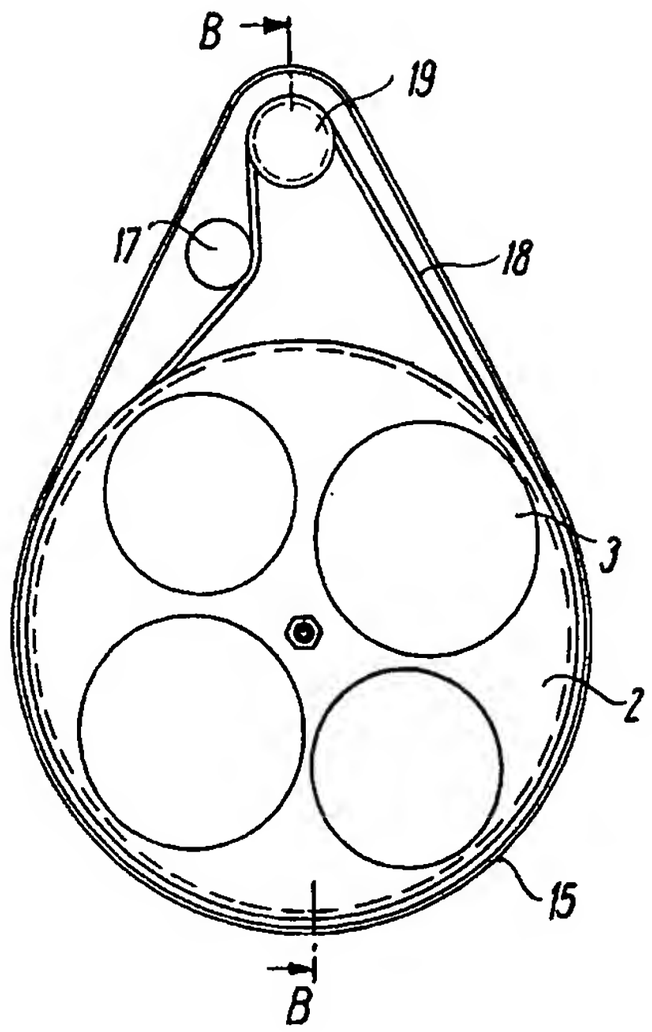

Fig. 4

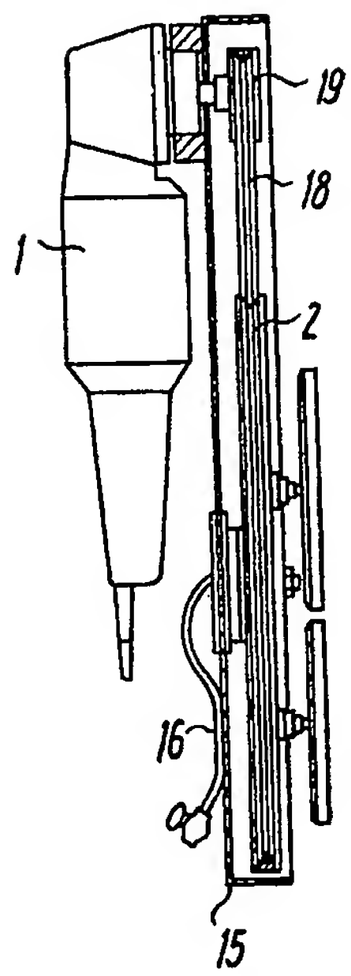

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Fig. 5

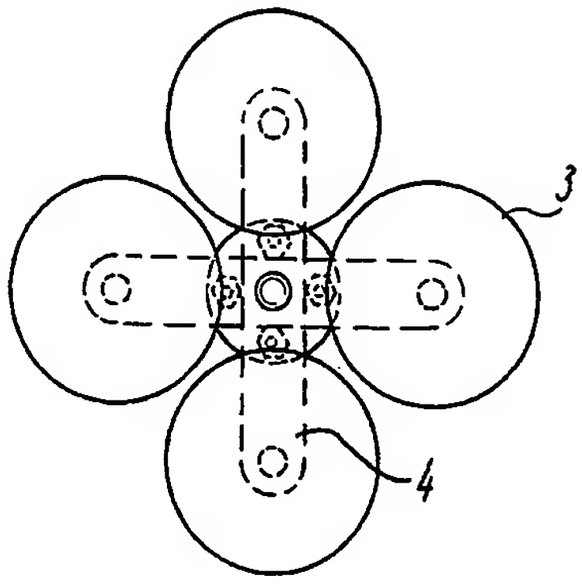

Fig. 6

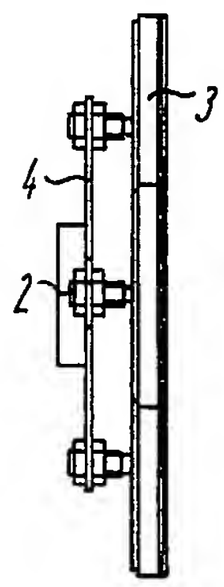

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Fig. 7

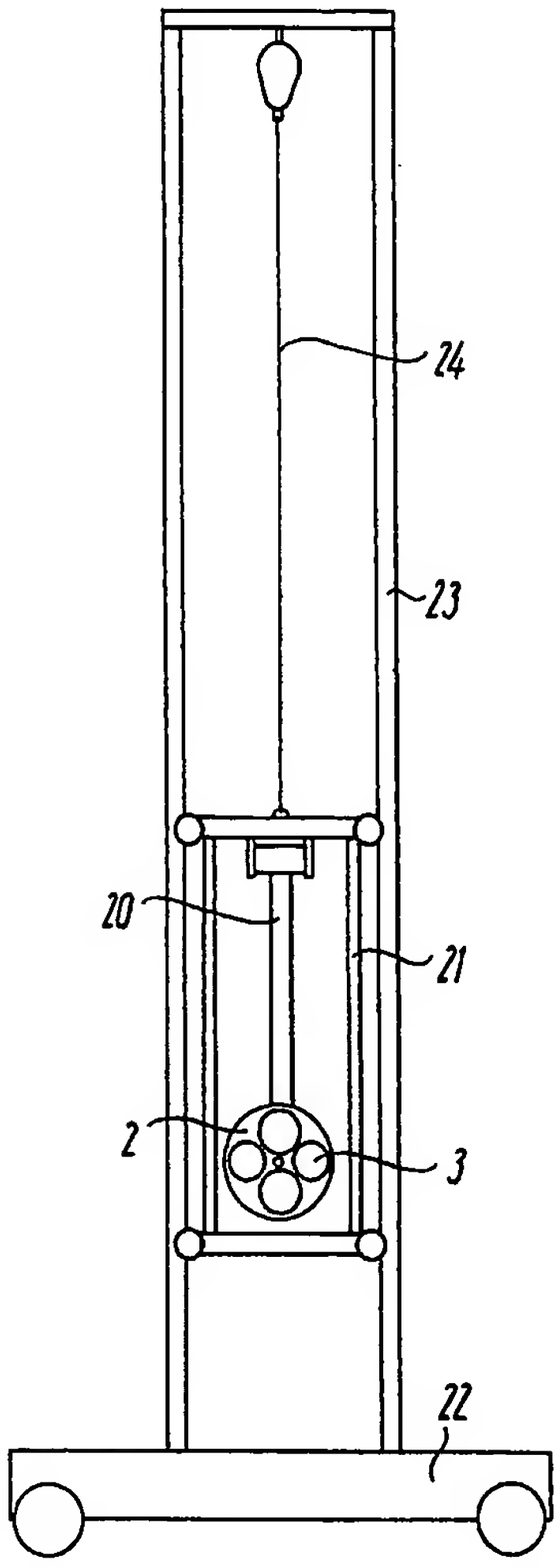

Fig. 8